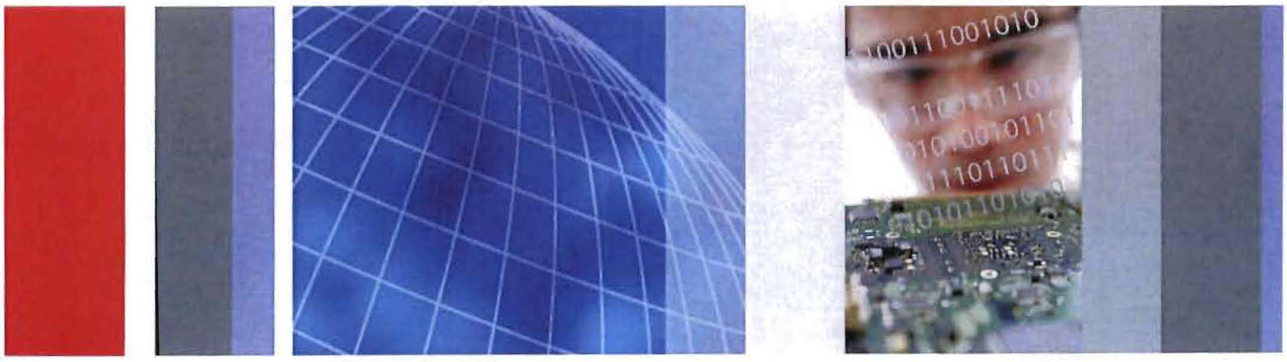
DMM4040 and 4050
Digital Multimeters

Safety and Installation Instructions
安全性および設置マニュアル
安全及安装说明



071-2693-00

Tektronix

Tektronix®

DMM4040 and 4050

Digital Multimeters

Safety and Installation Instructions

071-2693-00
3525290

Contacting Tektronix, Inc.

Tektronix, Inc.
14200 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:
- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty

Tektronix warrants that the product will be free from defects in materials and workmanship for a period of three (3) years from the date of original purchase from an authorized Tektronix distributor. If the product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Batteries are excluded from this warranty. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, shipping charges prepaid, and with a copy of customer proof of purchase. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

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Safety and Installation

About this Manual

This manual contains the safety and installation information that a new user will need to set up the Tektronix DMM4040 or DMM4050 Digital Multimeter (hereafter referred to as the Meter) prior to operation. You will also find compliance information, environmental considerations, general and electrical specifications, a list of available user documentation, and a list of standard and optional accessories for the Meter.

Introduction

Both Meters are 6-1/2 digit, dual-display multimeters designed for bench-top, field service, and system applications. Their full complement of measurement functions plus their RS-232, IEEE 488, and Ethernet Remote Interfaces make these multimeters ideal candidates for precision manual measurements and use in automated systems. For portability, these multimeters include a carrying handle that also serves as a bail for bench top operation.

There are a few feature differences between these two multimeters, and some specifications are tighter for thc DMM4050. Features that exist in only one multimeter will be identified with the addition of "4050 Only" by each feature that is found only in that model. Separate specification tables are also used to clarify the differences between these two models.

The following is a list of some of the features and functions:

- Bright, large-digit, wide-viewing-angle display
- Dual display for displaying two properties of an input signal (e.g., ac voltage in one display and frequency in the other).
- Remote operation via IEEE 488, RS-232, and Ethernet interface.
- Trigger in and measurement-complete out
- Front panel USB port for optional memory
- 6-1/2 digit resolution
- Half-rack width
- True rms ac
- 2 and 4-wire resistance measurements
- Extended 10 Ω and 1 GΩ ranges
- Frequency measurements to 1 MHz
- Capacitance measurements (4050 Only)

- Temperature measurement (4050 Only)
- 10 A current capability
- Decibels (dB and dBm) with variable reference impedance and audio power measurement capability
- Input terminals on both front and rear panels of the meter
- Closed-case calibration (no internal calibration adjustments)

User Documentation

The user documentation for this Meter includes the following:

Accessory	Where to find	Part number
Safety and Installation Instructions (This manual)		071-2693-xx
Technical Reference (Specifications and Performance Verification)		077-0362-xx
Programmer Manual		077-0363-xx
Users Manual Available in the following languages:		
English		077-0361-xx
French		077-0366-xx
Italian		077-0367-xx
German		077-0368-xx
Spanish		077-0370-xx
Japanese		077-0371-xx
S. Chinese		077-0372-xx
T. Chinese		077-0373-xx
Korean		077-0374-xx
Russian		077-0375-xx

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any other products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

This instrument has been designed and tested in accordance with the European standard publication EN 61010-1:2001 and U.S./Canadian standard publications UL 61010-1 and CAN/CSA-C22.2 No.61010-1-04. The instrument has been supplied in a safe condition.

This manual contains information and warnings that must be observed to keep the instrument in a safe condition and ensure safe operation.

To use the instrument correctly and safely, read and follow the precautions in this section and follow all the safety instructions or warnings given throughout this manual that relate to specific measurement functions. In addition, follow all generally accepted safety practices and procedures required when working with and around electricity.

CAT I equipment is designed to protect against transients from high-voltage, low-energy sources, such as electronic circuits or a copy machine.

CAT II equipment is designed to protect against transients from energy-consuming equipment supplied from the fixed installtion, such as TVs, PCs, portable tools, and other householsd appliances.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Use Proper Voltage Setting. Before applying power, ensure that the line selector is in the proper position for the source being used.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power Disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Do Not Operate With Suspected Failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Keep Product Surfaces Clean and Dry.

⚠⚠ Warning

To avoid electric shock, personal injury, or death, read the following before using the Meter.

- Use the Meter only as specified in this manual, or the protection provided by the Meter might be impaired.
- Do not use the Meter in wet environments.
- Inspect the Meter before using it. Do not use the Meter if it appears damaged.
- Inspect the test leads before use. Do not use them if insulation is damaged or metal is exposed. Check the test leads for continuity. Replace damaged test leads before using the Meter.
- Verify the Meter's operation by measuring a known voltage before and after using it. Do not use the Meter if it operates abnormally. Protection may be impaired. If in doubt, have the Meter serviced.
- Whenever it is likely that safety protection has been impaired, make the Meter inoperative and secure it against any unintended operation.
- Servicing of the Meter should be performed by qualified service personnel.
- Do not apply more than the rated voltage, as marked on the Meter, between the terminals or between any terminal and earth ground.
- While in IEC Measurement Category II environments, do not apply voltages above 600 V ac to the input of the Meter. See "Description of IEC 61010 Measurement Categories" later in this manual.
- Always use the power cord and connector appropriate for the voltage and outlet of the country or location in which you are working.
- Always use a power cord with a ground connection and ensure the ground is properly connected to the power distribution system.
- Remove test leads from the Meter before opening the case.
- Never remove the cover or open the case of the Meter without first removing it from the main power source.
- Use caution when working with voltages above 30 V ac rms, 42 V ac peak, or 42 V dc. These voltages pose a shock hazard.
- Use only the replacement fuse(s) specified by the manual.
- Use the proper terminals, function, and range for your measurements.
- Do not operate the Meter around explosive gas, vapor, or dust.
- When using probes, keep your fingers behind the finger guards.
- When making electrical connections, connect the common test lead before connecting the live test lead; when disconnecting, disconnect the live test lead before disconnecting the common test lead.
- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.
- Before measuring current, check the Meter's fuses and turn OFF power to the circuit before connecting the Meter to the circuit.
- When servicing the Meter, use only specified replacement parts.
- To prevent damage to the Meter, do not change the position of the Front/Rear switch while signals are applied to either the front or rear input terminals.

Symbols and Terms

The following terms and safety and electrical symbols may appear in the manual or on the product:

A ⚠⚠ **Warning** statement identifies conditions or practices that could result in injury or death.

A ⚠ **Caution** statement identifies conditions or practices that could result in damage to the Meter or equipment to which it is connected.

⚠⚠ Warning

To avoid electric shock, personal injury, or death, carefully read the information under "General Safety Summary" before attempting to install, use, or service the Meter.

Safety and Electrical Symbols

Symbol	Description	Symbol	Description
⚠	Risk of danger. Important information. See manual.	⏻	Display ON / OFF and Meter reset.
⚠	Hazardous voltage. Voltage > 30 V dc or ac peak might be present.	⏚	Earth ground
~	AC (Alternating Current)	⊣⊢	Capacitance
⎓	DC (Direct Current)	⭢	Diode
≂ or ≂⎓	AC or DC (Alternating or Direct Current)	⏛	Fuse
ıı))	Continuity test or continuity beeper tone	⎍	Digital signal
ϟ	Potentially hazardous voltage		Maintenance or Service
⧈	Double insulated		Static awareness. Static discharge can damage parts.
CAT II	Measurement Category II is for measurements performed on circuits directly connected to the low voltage installation.	CAT I	Measurement Category I is for measurements not directly connected to mains.

Description of IEC 61010 Measurement Categories

The IEC 61010 safety standard defines four Overvoltage (Installation) Categories (CAT I to CAT IV) based on the magnitude of danger from transient impulses as shown in Figure 1.

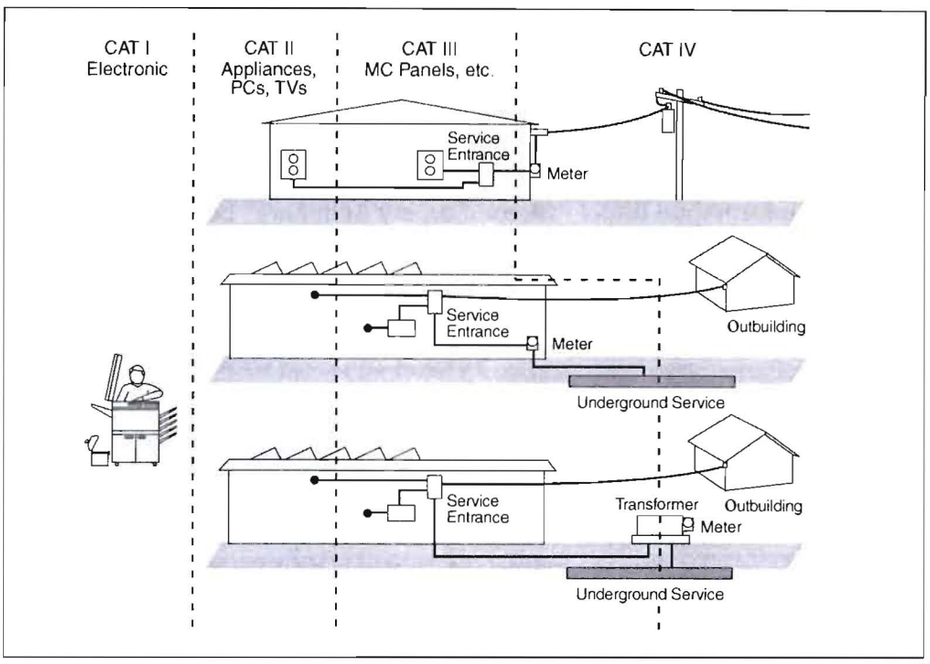

Figure 1. IEC 61010 Measurement Category (CAT) Levels

The IEC 61010 Measurement CAT level indicates the level of protection the instrument provides against impulse withstand voltage.

CAT I equipment is designed to protect against transients from high-voltage, low-energy sources, such as electronic circuits or a copy machine.

CAT II equipment is designed to protect against transients from energy-consuming equipment supplied from the fixed installation, such as TVs, PCs, portable tools, and other household appliances.

CAT III equipment is designed to protect against transients in equipment in fixed equipment installations, such as distribution panels, feeders and short branch circuits, and lighting systems in large buildings.

CAT IV equipment is designed to protect against transients from the primary supply level, such as an electricity meter or an overhead or underground utility service.

Compliance Information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies.

EMC Compliance

EC Declaration of Conformity—EMC

Meets intent of Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1 2006, EN 61326-2 2006. EMC requirements for electrical equipment for measurement, control, and laboratory use. [1, 2, 3]

- CISPR 11:2003. Radiated and conducted emissions, Group 1, Class A
- IEC 61000-4-2:2001. Electrostatic discharge immunity
- IEC 61000-4-3:2002. RF electromagnetic field immunity 4
- IEC 61000-4-4:2004. Electrical fast transient/burst immunity
- IEC 61000-4-5:2001. Power line surge immunity
- IEC 61000-4-6:2003. Conducted RF immunity 5
- IEC 61000-4-11:2004. Voltage dips and interruptions immunity 6, 7

EN 61000-3-2:2006. AC power line harmonic emissions.

EN 61000-3-3:1995. Voltage changes, fluctuations, and flicker.

European Contact.

Tektronix UK, Ltd.
Western Peninsula
Western Road
Bracknell, RG12 1RF
United Kingdom

1 This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

2 Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object.

3 To ensure compliance with the EMC standards listed here, high quality shielded interface cables should be used.

4 The tolerance of the 100uADC, 10mADC ranges while subjected to the test field (3 V/m over the frequency range of 80 MHz to 1 GHz, 1.4 GHz to 2.0 GHz, and 1V/m from 2.0 GHz to 2.7 GHz, with 80% amplitude modulation at 1 kHz) can increase by +/- (0.06% of range) over the frequency range of 1.7 - 1.9GHz. (IEC 61000-4-3).

5 The tolerance of the 100uADC, 10mADC ranges while subjected to the injected test signal (3 V rms over the frequency range of 150 kHz to 80 MHz, with 80% amplitude modulation at 1 kHz) can increase by +/- (0.08% of range) at the frequency range of 20 - 50MHz. (IEC 61000-4-6).

6 Performance Criterion C applied at the 70%/25 cycle Voltage-Dip and the 0%/250 cycle Voltage-Interruption test levels (IEC 61000-4-11).

7 Instrument rebooting may be experienced where the EUT takes approximately 18 seconds to recover from IEC 61000-4-11 transient immunity test.

Australia / New Zealand Declaration of Conformity – EMC

Complies with the EMC provision of the Radiocommunications Act per the following standard, in accordance with ACMA:

CISPR 11:2003. Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN 61326-1:2006 and EN 61326-2-1:2006.

Safety Compliance

EC Declaration of Conformity – Low Voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:

Low Voltage Directive 2006/95/EC.

- **EN 61010-1: 2001.** Safety requirements for electrical equipment for measurement control and laboratory use.

U.S Nationally Recognized Testing Laboratory Listing

- **ISA-82.02.01.** Safety Standard for Electrical and Electronic Test, Measuring, Controlling and Related Equipment -- General Requirements.

Canadian Certification

- **CAN/CSA-C22.2 No. 61010-1:2004.** Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1.

Additional Compliances

- **IEC 61010-1: 2001.** Safety requirements for electrical equipment for measurement, control, and laboratory use.
- **ANSI/UL 61010-1:2004, 2nd Edition.** Standard for electrical measuring and test equipment.

Equipment Type

Test and measuring.

Safety Class

Class 1 — grounded product.

Pollution Degree Description

A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.

- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution Degree

Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor use only.

Measurement Overvoltage Categories

CAT I – 1000V / CAT II – 600V

Environmental Considerations

This section provides information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling

Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2002/96/EC and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive.

Perchlorate Materials

This product contains one or more type CR lithium batteries. According to the state of California, CR lithium batteries are classified as perchlorate materials and require special handling. See www.dtsc.ca.gov/hazardouswaste/perchlorate for additional information.

Unpacking and Inspecting the Meter

Every care is taken in the choice of packing material to ensure that your Meter will reach you in perfect condition. If the Meter has been subject to excessive handling in transit, there may be visible external damage to the shipping carton. In the event of damage, keep the shipping container and packing material for the carrier's inspection.

Carefully unpack the Meter from its shipping container and inspect the contents for damaged or missing items. If the Meter appears damaged or something is missing, contact the carrier and Tektronix immediately. Save the container and packing material in case you have to return the Meter.

Storing and Shipping the Meter

To prepare the Meter for storage or shipping, use the original shipping container if possible, as it provides shock isolation for normal handling operations. If the original shipping container is not available, use a box that is 17.5 x 15.5 x 8.0 inches, with cushioning material that fills the space between the Meter and the sides of the box.

To store the Meter, place the box under cover in a location that complies with the storage environment specifications described in the "General Specifications" section later in this manual.

Power Considerations

The Meter operates on varying power distribution standards found throughout the world and must be set up to operate on the line voltage that will power it. The Meter is packed ready for use with a line voltage determined at the time of ordering. If the selected line voltage does not match the power that the Meter will be plugged into, the Meter's line-voltage setting must be changed and replacement of the line fuse may be required.

Selecting the Line Voltage

The Meter operates on four different input line voltages. The selected line-voltage setting is visible through the window in the line-fuse holder on the Meter's rear panel.

1. Unplug the power cord.
2. Insert a small screwdriver blade into the narrow recess to the left of the fuse holder and pry it to the right until the holder pops out. See Figure 2.
3. Remove the voltage-selector block from the fuse holder.
4. Rotate the selector block until the desired voltage rating faces outward.
5. Replace the selector block back into the fuse holder.
6. Install the fuse holder back into the Meter and reconnect the power cord.

Changing the line-voltage setting may require a different line-power fuse for proper operation.

Replacing the Fuses

The Meter uses one fuse to protect the line-power input and two fuses to protect current-measurement inputs.

Line-Power Fuse

The Meter has a line-power fuse in series with the power supply. Table 1 indicates the proper fuse for each of the four line-voltage selections. The line-power fuse is accessed through the rear panel.

1. Unplug the power cord.
2. Insert a small screwdriver blade into the narrow recess to the left of the fuse holder and pry it to the right until the holder pops out. See Figure 2.
3. Remove the fuse and replace it with a fuse of an appropriate rating for the selected line-power voltage. See Table 1.
4. Replace the selector block back into the fuse holder.

⚠⚠ Warning

To avoid electric shock or fire, do not use makeshift fuses or short-circuit the fuse holder.

Table 1. Line Voltage to Fuse Rating

Line Voltage Selection	Fuse Rating
100 / 120	0.25 A, 250 V (slow blow)
220 / 240	0.125 A, 250 V (slow blow)

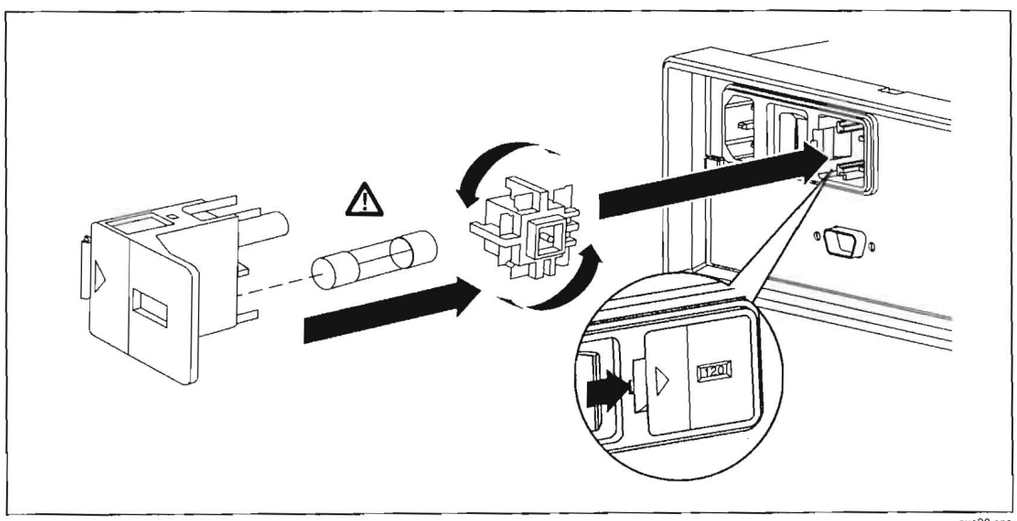

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Figure 2. Replacing the Line-Power Fuse

Current-Input Fuses

The **400 mA** and **10 A** inputs are protected by user-replaceable fuses.

- The **400 mA** input is protected by a fuse (F2) rated at 440 mA, 1000 V (fast blow), 10,000 A minimum breaking capacity.
- The **10 A** input is protected by a fuse (F1) rated at 11 A, 1000 V (fast blow), 10,000 A minimum breaking capacity.

⚠⚠ Warning

For protection against fire or arc flash, replace a blown fuse with a fuse of an identical rating.

To test the current-input fuses:

1. With the Meter powered up, plug a test lead into the **VΩ** connector.
2. Press [Ω].
3. Insert the other end of the test lead into the 400 mA input connector.

   If the fuse is good, the Meter will read less than 200 Ω. If the fuse is blown, the Meter will read `overload`.
4. Remove the probe from the 400 mA connector and insert into the 10 A connector.

   If the fuse is good, the Meter will read less than 1 Ω. If the fuse is blown, the Meter will read `overload`.

⚠⚠ Warning

To avoid electric shock, remove the power cord and any test leads from the Meter before opening the current-input fuse access door.

To replace the current-input fuses:

1. Unplug the power cord.
2. Turn the Meter upside down.
3. Remove the retaining screw on the fuse access door. See Figure 3.
4. Remove the protective cover from the fuse holders by slightly depressing the back edge of the cover to unlatch it from the printed circuit board. Pull up on the back edge of the cover and remove it from the fuse compartment.
5. Remove the defective fuse and replace it with a fuse of an appropriate rating. See Table 1.
6. Replace the protective cover by pushing it over the fuses while aligning the catches with the holes in the printed circuit board. Press the cover down until the catches engage the printed circuit board.
7. Replace the fuse access door and install the retaining screw.

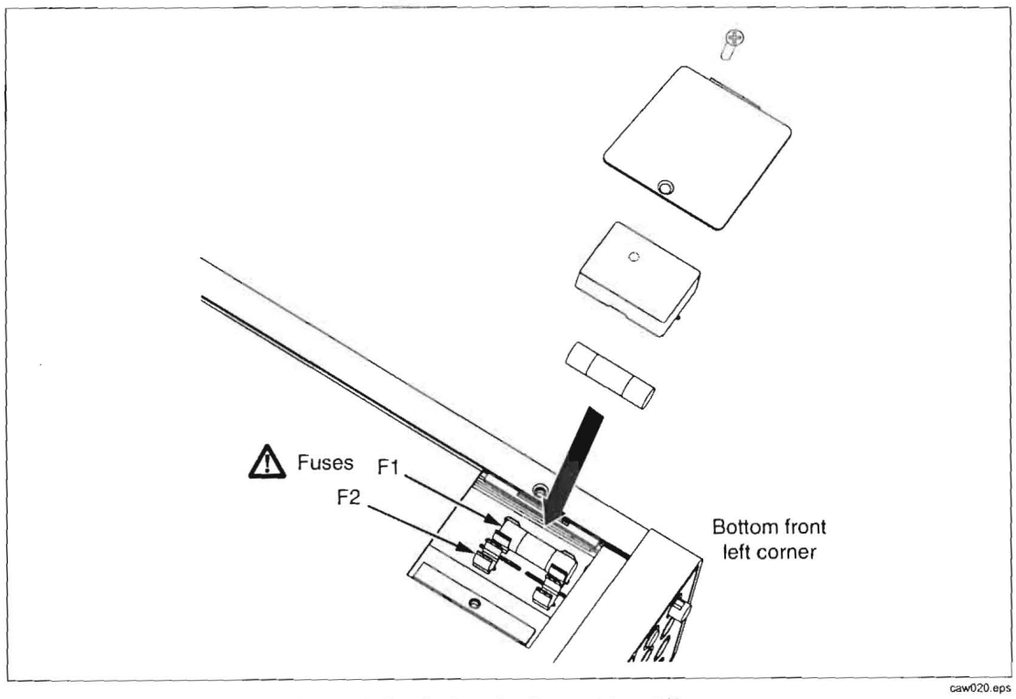


Figure 3. Replacing the Current-Input Fuses

Connecting to Line Power

⚠⚠ Warning

To avoid shock hazard, connect the factory supplied three-conductor line power cord to a properly grounded power outlet. Do not use a two-conductor adapter or extension cord, as this will break the protective ground connection. If a two-conductor power cord must be used, a protective grounding wire must be connected between the ground terminal and earth ground before connecting the power cord or operating the Meter.

1. Verify that the line voltage selector block is set to the correct setting.
2. Verify that the correct fuse for the line voltage is installed.
3. Connect the power cord to a properly grounded three-prong outlet. Refer to Table 2 for descriptions of the line-power cord types available from Tektronix.

Table 2. Line-Power Cord Types Available from Tektronix

Type	Voltage / Current	Tektronix Part Number
North America	120 V / 15 A	161-0066-00
North America	250 V / 10 A	161-0066-12
Universal Euro	250 V / 10 A	161-0066-09
United Kingdom	250 V / 10 A	161-0066-10
Switzerland	250 V / 10 A	161-0154-00
Australia	250 V / 10 A	161-0066-13
Japan	125V / 7A	161-0298-00
China	250V / 10A	161-0304-00

Turning Power On

1. If required, connect the Meter to line power.
2. Toggle the power switch on the rear panel so the "I" side of the switch is depressed. The Meter will turn on and briefly illuminate all LCD segments.

Note

To save on power consumption, the Meter can be set to a standby mode by pressing ⏻ on the front panel. Press it again to bring the Meter up to full power.

Adjusting the Bail

The bail (handle) is adjustable to provide two viewing angles. The bail is also adjustable for carrying or storing the Meter.

To adjust the bail, pull the ends out to a hard stop (about 1/4-inch on each side) and then rotate it to one of the four stop positions as shown in Figure 4.

To remove the bail, adjust it to the vertical stop position and pull the ends all the way out.

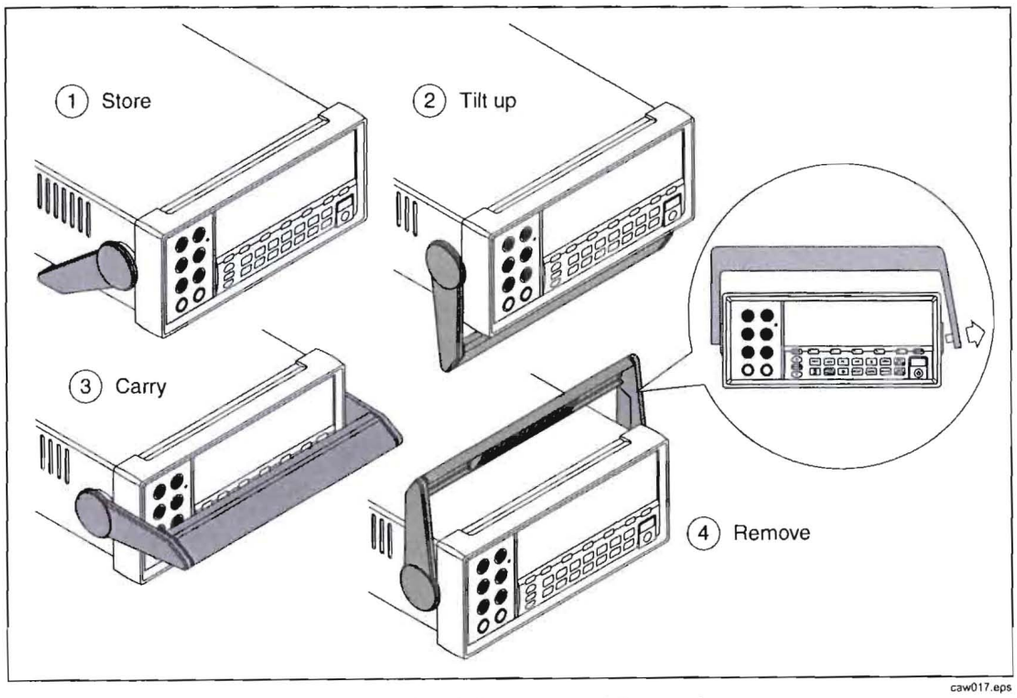


Figure 4. Bail Adjustment and Removal

Installing the Meter into an Equipment Rack

The Meter is mountable in a standard 19-inch rack using a rack mount kit. See the "Options and Accessories" section later in this manual for ordering information.

To prepare the Meter for rack mounting, remove the bail and remove the front and rear protective boots. To remove a boot, stretch a corner then slide it off as shown in Figure 5.

To install the Meter into the rack, refer to the instructions provided with the Rack Mount Kit.

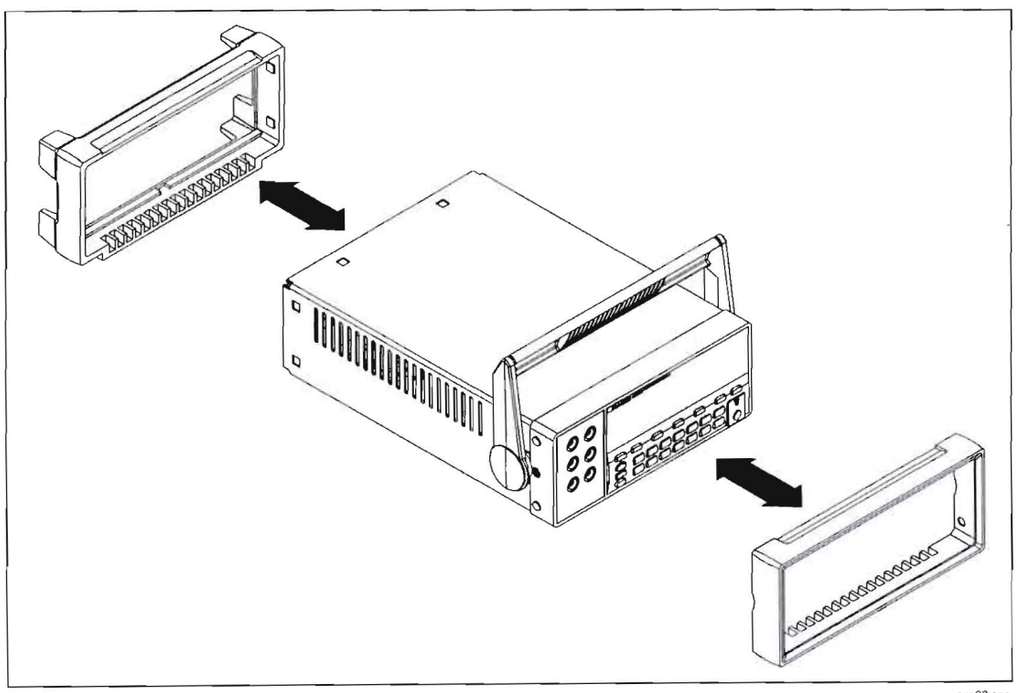


Figure 5. Boot Removal

Front Panel Features

The Meter can be controlled either by sending commands through one of its communication interfaces or by manually operating its front panel controls. The front panel has three main elements: input terminals (on the left), dual display (primary and secondary displays), and keypad. See Figure 6 for an overview of the front panel and refer to Table 3 for descriptions of the front-panel features.

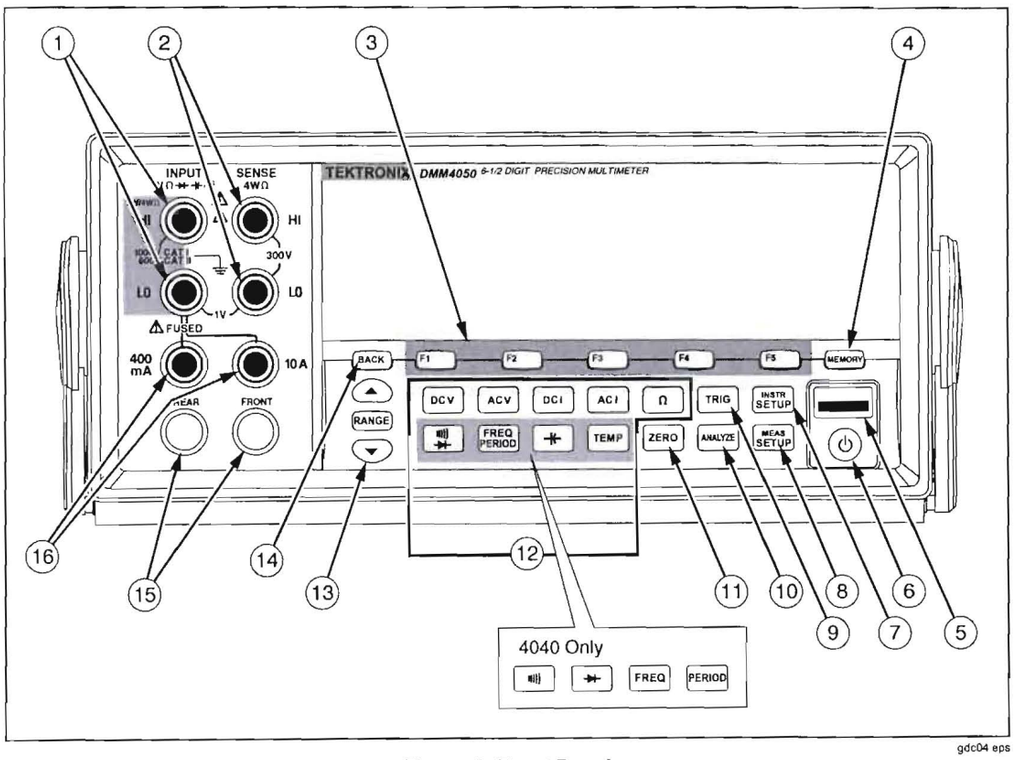


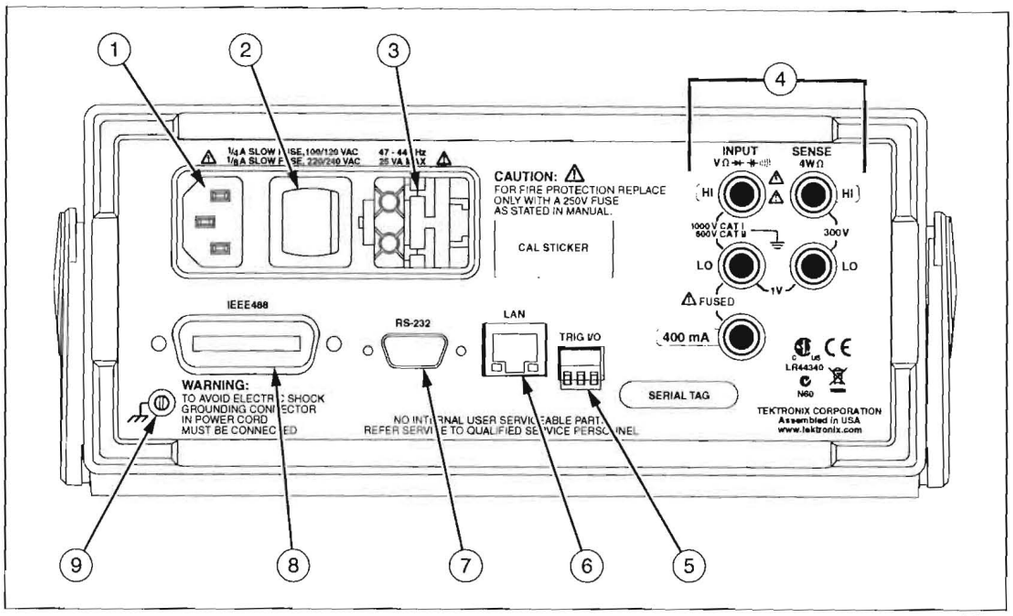
Figure 6. Front Panel

Table 3. Front Panel Features

Item	Description
①	Input HI and LO connectors. Input connectors for Volts, 2-wire Ohms, Hz, Period, Temperature, and Capacitance measurements. Input connectors source current for 4-wire Ohms measurements. All measurements use the Input LO connector as a common input. The LO input is isolated, and may be safely floated up to 1000 V above earth ground regardless of the measurement type. 1000 V is the maximum voltage rating between the Input HI and LO connectors and between each HI and LO input and earth ground.
②	Sense HI and LO connectors. Sense connectors sense the voltage across the unknown resistance for 4-wire Ohms measurements or provide the DCV reference Input for DCV Ratio measurements.
③	Soft keys F1 through F5. Soft keys are used to select various menu options while navigating the Meter's menus. Each soft key's function is identified with a label in the bottom row of the display. Keys without a label above them are inactive
④	Memory key for accessing internal and external memory containing meter setups and measurements. See the "Accessing and Controlling Memory" section for more information.
⑤	USB Port. Connection for USB memory device that can be used to store meter readings (memory device not included).
⑥	Standby key to turn off the display. While in standby, the Meter will not respond to remote or front-panel commands. When taken out of standby, the Meter sets itself to its power-up configuration.
⑦	Instrument Setup key. Accesses communication interface selection and setup, remote command set, system settings, and meter reset.
⑧	Measurement Setup key. Accesses to resolution setting, trigger functions, temperature setup, dBm reference selection, continuity settings, and other measurement related parameters.
⑨	Trigger key. Triggers measurement when trigger is set to external triggering. See the "Controlling Trigger Functions" section later in this chapter to learn how to use the trigger key (TRIG) to control the Meter's measurement cycle.
⑩	Analyze key. Accesses math functions, Statistics, TrendPlot, and Histogram.
⑪	Zero key. Uses the present reading as an offset value to create relative readings.
⑫	Meter function keys. Selects meter function between volts dc, volts ac, amp dc, amps ac, ohms, continuity, diode test, frequency, period, capacitance [1], and temperature [1]. For the 4040, the lower four keys select different functions; see inset.
⑬	Range keys. Selects between manual and auto range mode. Also increases or decreases the range when in manual ranging mode.
⑭	Back key. Backs up one layer in the menu selection.
⑮	Front and Rear input switch. All front-panel input connectors, except 10 A, are available on the rear-panel of the Meter. These switches switch the Meter's input between them.
⑯	400 mA and 10 A input connectors for ac and dc current measurement functions.
Notes: [1] Available on 4050 only	

Rear Panel Features

Figure 7 shows the rear panel and Table 4 indicates the connections on the rear panel and describes their use.



gdc05.eps

Figure 7. Rear Panel

Table 4. Rear Panel Features

Item	Description
①	Line Power Cord connector
②	Power Switch
③	Fuse holder and power line voltage selector
④	Rear-panel input connectors[1]
⑤	External trigger input and measurement complete output port
⑥	Ethernet (LAN) connector
⑦	RS-232 connector
⑧	IEEE 488 (GPIB) connector
⑨	Ground connector

Notes:

[1] 10 A current measurements can not be performed through the rear-panel connectors

Options and Accessories

Table 5 lists available options and accessories.

Table 5. Accessories

Model / Part Number [1]	Description
TL710 196-3520-00	Premium Test Lead Set
TP750	100 Ohm RTD Temperature Probe (DMM4050 only)
013-0369-00	Calibration fixture; 4 terminal shorting bar
Y8846S (Fluke)	Rack Mount Kit Single
Y8846D (Fluke)	Rackmount Kit Dual
TL705	2X4 Wire Ohm Precision Test Leads
TL725	2X4 Wire Ohm Tweezers Test Leads
159-0487-00	F1 Fuse, 11 A, 1000 V, Fast, .406INX1.5IN, Bulk
159-0488-00	F2 Fuse, 440 mA, 1000 V, Fast, .406X1.375, Bulk
174-5813-00	USB to RS-232 cable assembly
012-0991-01	GPIB cable; Low EMI; 1 meter
159-0187-00	Fuse, 0.25 A, 250 V AC, slow blow
159-0063-00	Fuse, 0.125 A, 250 V, slow blow
HCTEK4321	Hard case, plastic
AC4000	Soft case, nylon

[1] All model and part numbers for non-Tektronix products have the vendor listed in parentheses.

Cleaning the Meter

⚠⚠ Warning

To avoid electric shock or damage to the Meter, never get water inside the Meter.

⚠ Caution

To avoid damaging the Meter's housing, do not apply solvents to the Meter.

If the Meter requires cleaning, wipe it down with a cloth that is lightly dampened with water or a mild detergent. Do not use aromatic hydrocarbons, alcohol, chlorinated solvents, or methanol-based fluids when wiping down the Meter.

General Specifications

Power

Voltage

100 V Setting	90 V to 110 V
120 V Setting	108 V to 132 V
220 V Setting	198 V to 242 V
240 V Setting	216 V to 264 V
Frequency	47 Hz to 440 Hz. Automatically sensed at power-on.
Power Consumption	28 VA peak (12 Watt average)

Dimensions

Height	88 mm (3.46 in.)
Width	217 mm (8.56 in.)
Depth	297 mm (11.7 in.)
Weight	3.6 kg (8.0 lb)
Shipping Weight	5.0 kg (11.0 lb)

Display

Vacuum Fluorescent Display, dot matrix

Environment

Temperature

Operating	0 °C to 55 °C
Storage	-40 °C to 70 °C
Warm Up	1 hour to full uncertainty specifications

Relative Humidity (non-condensing)

Operating	0 °C to 28 °C <90 % 28 °C to 40 °C <80 % 40 °C to 55 °C <50 %
Storage	-40 °C to 70 °C <95 %

Altitude

Operating	2,000 Meters
Storage	12,000 Meters
Vibration and Shock	Complies with MIL-PRF-28800F Class 3

Triggering

Samples per Trigger	1 to 50,000
Trigger Delay	0 s to 3600 s; in 10 µS increments
External Trigger Delay	<1 mS
External Trigger Jitter	<500 µS
Trigger Input	TTL Levels
Trigger Output	5 V maximum (open collector)

Memory

10,000 measurements, internal, and up to 2 Gigabyte capacity with a USB memory module through front-panel USB port

Math Functions

Zero, dBm, dB, MX+B, Offset, DCV ratio and TrendPlot, Histogram, Statistics (min/max/average/standard deviation), and Limit Test

Electrical

Input Protection ..... 1000 V all ranges

Overrange ..... 20 % on all ranges except 1000 V dc, 1000 V ac (4050), 750 V ac (4040), Diode, and 10 A ranges

Remote Interfaces

RS-232C, DTE 9-pin, 1200 to 230400 baud (RS-232C to USB cable available to connect the Meter to a PC USB port. See Accessories)

IEEE 488.2

LAN and "Ethernet 10/100 base T with DHCP (for IP_ADDRess) option"

Warranty

Three years

Electrical Specifications

Accuracy specifications are valid for 6½ digit resolution mode after at least a 1-hour warm-up with Auto Zero enabled.

24-hour specifications are relative to calibration standards and assume a controlled electromagnetic environment per EN 61326-1:2000-11

DC Voltage Specifications

Maximum Input ..... 1000 V on any range

Common Mode Rejection ..... 140 dB at 50 or 60 Hz ±0.1 % (1 kΩ unbalance)

Normal Mode Rejection ..... 60 dB for NPLC of 1 or greater with analog filter off and power line frequency ±0.1 %
100 dB for NPLC of 1 or greater with analog filter on and power line frequency ±0.1 %

Measurement Method ..... Multi-ramp A/D

A/D Linearity ..... 0.0002 % of measurement +0.0001 % of range

Input Bias Current ..... <30 pA at 25 °C

Autozero Off Operation ..... Following instrument warm-up at calibration temperature ±1 °C and less than 10 minutes, add error: 0.0002 % range additional error +5 µV.

Analog Filter ..... When using the analog filter, specifications are relative to within one hour of using the ZERO function for that range and NPLC setting.

DC Ratio ..... Accuracy is +/- (Input accuracy + Reference accuracy), where Input accuracy = DC Voltage accuracy for the HI to LO Input (in ppm of the Input voltage), and Reference accuracy = DC Voltage accuracy for the HI to LO (Sense) Reference (in ppm of the Reference voltage).

Settling Considerations ..... Measurement settling times are affected by source impedance, cable dielectric characteristics, and input signal changes.

Input Characteristics

Range	Resolution	Resolution			Input Impedance
		4½ Digits	5½ Digits	6½ Digits	
100 mV	100.0000 mV	10 µV	1 µV	100 nV	10 MΩ or >10 GΩ [1]
1 V	1.000000 V	100 µV	10 µV	1 µV	10 MΩ or >10 GΩ [1]
10 V	10.00000 V	1 mV	100 µV	10 µV	10 MΩ or >10 GΩ [1]
100 V	100.0000 V	10 mV	1 mV	100 µV	10 MΩ ±1%
1000 V	1,000.000 V	100 mV	10 mV	1 mV	10 MΩ ±1%

[1] Inputs beyond ±14 V are clamped through 200 kΩ typical. 10 MΩ is default input impedance.

4050 Accuracy

Accuracy is given as ± (% measurement + % of range)

Range	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
100 mV	0.0025 + 0.003	0.0025 + 0.0035	0.0037 + 0.0035	0.0005 + 0.0005
1 V	0.0018 + 0.0006	0.0018 + 0.0007	0.0025 + 0.0007	0.0005 + 0.0001
10 V	0.0013 + 0.0004	0.0018 + 0.0005	0.0024 + 0.0005	0.0005 + 0.0001
100 V	0.0018 + 0.0006	0.0027 + 0.0006	0.0038 + 0.0006	0.0005 + 0.0001
1000 V	0.0018 + 0.0006	0.0031 + 0.001	0.0041 + 0.001	0.0005 + 0.0001

4040 Accuracy

Accuracy is given as ± (% measurement + % of range)

Range	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
100 mV	0.003 + 0.003	0.004 + 0.0035	0.005 + 0.0035	0.0005 + 0.0005
1 V	0.002 + 0.0006	0.003 + 0.0007	0.004 + 0.0007	0.0005 + 0.0001
10 V	0.0015 + 0.0004	0.002 + 0.0005	0.0035 + 0.0005	0.0005 + 0.0001
100 V	0.002 + 0.0006	0.0035 + 0.0006	0.0045 + 0.0006	0.0005 + 0.0001
1000 V	0.002 + 0.0006	0.0035 + 0.0010	0.0045 + 0.0010	0.0005 + 0.0001

Additional Errors

Digits	NPLC	Additional NPLC Noise Error
6½	100	0 % of range
6½	10	0 % of range
5½	1	0.001 % of range
5½	.2	0.0025 % of range +12 µV
4½	0.02	0.017 % of range +17 µV

AC Voltage Specifications

AC Voltage specifications are for ac sinewave signals >5 % of range. For inputs from 1 % to 5 % of range and <50 kHz, add an additional error of 0.1 % of range, and for 50 kHz to 100 kHz, add 0.13 % of range.

Maximum Input ..... 1000 V rms or 1414 V peak or 8 x 10^7 volts-Hertz product (whichever is less) for any range.

Measurement Method ..... AC-coupled true-rms. Measures the ac component of input with up to 1000 V dc bias on any range.

AC Filter Bandwidth:

- Slow ..... 3 Hz – 300 kHz
- Medium ..... 20 Hz – 300 kHz
- Fast ..... 200 Hz – 300 kHz

Common Mode Rejection ..... 70 dB at 50 Hz or 60 Hz ±0.1 % (1 kΩ unbalance)

Crest Factor Error (applies to non-sinusoidal waveforms only)

- Maximum Crest Factor ..... 5:1 at Full Scale
- Additional Crest Factor Errors (<100 Hz)..... Crest factor 1-2, 0.05 % of full scale
  Crest factor 2-3, 0.2 % of full scale
  Crest factor 3-4, 0.4 % of full scale
  Crest factor 4-5, 0.5 % of full scale

Input Characteristics

Range	Resolution	Resolution			Input Impedance
		4½ Digits	5½ Digits	6½ Digits	
100 mV	100.0000 mV	10 µV	1 µV	100 nV	
1 V	1.000000 V	100 µV	10 µV	1 µV	1 MΩ ±2 % shunted by <100 pf
10 V	10.00000 V	1 mV	100 µV	10 µV	
100 V	100.0000 V	10 mV	1 mV	100 µV	
1000 V	1,000.000 V	100 mV	10 mV	1 mV	

4040/4050 Accuracy

Accuracy is given as ± (% measurement + % of range)

Range	Frequency	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
100 mV	3 – 5 Hz	1.0 + 0.03	1.0 + 0.04	1.0 + 0.04	0.1 + 0.004
	5 – 10 Hz	0.35 + 0.03	0.35 + 0.04	0.35 + 0.04	0.035 + 0.004
	10 Hz – 20 kHz	0.04 + 0.03	0.05 + 0.04	0.06 + 0.04	0.005 + 0.004
	20 – 50 kHz	0.1 + 0.05	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
	50 – 100 kHz	0.55 + 0.08	0.6 + 0.08	0.6 + 0.08	0.06 + 0.008
	100 – 300 kHz [1]	4.0 + 0.50	4.0 + 0.50	4.0 + 0.50	0.20 + 0.02
1 V	3 – 5 Hz	1.0 + 0.02	1.0 + 0.03	1.0 + 0.03	0.1 + 0.003
	5 – 10 Hz	0.35 + 0.02	0.35 + 0.03	0.35 + 0.03	0.035 + 0.003
	10 Hz – 20 kHz	0.04 + 0.02	0.05 + 0.03	0.06 + 0.03	0.005 + 0.003
	20 – 50 kHz	0.1 + 0.04	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
	50 – 100 kHz	0.55 + 0.08	0.6 + 0.08	0.6 + 0.08	0.06 + 0.008
	100 – 300 kHz [1]	4.0 + 0.50	4.0 + 0.50	4.0 + 0.50	0.2 + 0.02
10 V	3 – 5 Hz	1.0 + 0.02	1.0 + 0.03	1.0 + 0.03	0.1 + 0.003
	5 – 10 Hz	0.35 + 0.02	0.35 + 0.03	0.35 + 0.03	0.035 + 0.003
	10 Hz – 20 kHz	0.04 + 0.02	0.05 + 0.03	0.06 + 0.03	0.005 + 0.003
	20 – 50 kHz	0.1 + 0.04	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
	50 – 100 kHz	0.55 + 0.08	0.6 + 0.08	0.6 + 0.08	0.06 + 0.008
	100 – 300 kHz [1]	4.0 + 0.50	4.0 + 0.50	4.0 + 0.50	0.2 + 0.02
100 V	3 – 5 Hz	1.0 + 0.02	1.0 + 0.03	1.0 + 0.03	0.1 + 0.003
	5 – 10 Hz	0.35 + 0.02	0.35 + 0.03	0.35 + 0.03	0.035 + 0.003
	10 Hz – 20 kHz	0.04 + 0.02	0.05 + 0.03	0.06 + 0.03	0.005 + 0.003
	20 – 50 kHz	0.1 + 0.04	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
	50 – 100 kHz	0.55 + 0.08	0.6 + 0.08	0.6 + 0.08	0.06 + 0.008
	100 – 300 kHz [1]	4.0 + 0.50	4.0 + 0.50	4.0 + 0.50	0.2 + 0.02
1000 V	3 – 5 Hz	1.0 + 0.015	1.0 + 0.0225	1.0 + 0.0225	0.1 + 0.00225
	5 – 10 Hz	0.35 + 0.015	0.35 + 0.0225	0.35 + 0.0225	0.035 + 0.00225
	10 Hz – 20 kHz	0.04 + 0.015	0.05 + 0.0225	0.06 + 0.0225	0.005 + 0.00225
	20 – 50 kHz	0.1 + 0.03	0.11 + 0.0375	0.12 + 0.0375	0.011 + 0.00375
	50 – 100 kHz [2]	0.55 + 0.06	0.6 + 0.06	0.6 + 0.06	0.06 + 0.006
	100 – 300 kHz [1][2]	4.0 + 0.375	4.0 + 0.375	4.0 + 0.375	0.2 + 0.015

[1] Typically 30 % reading error at 1 MHz

[2] 1000 Volt range is limited to 8 X 10^7 volt-Hertz

Additional Low Frequency Errors

Error is stated as % of reading.

Frequency	AC Filter		
	3 HZ (slow)	20 HZ (medium)	200 HZ (fast)
10 – 20 Hz	0	0.25	–
20 – 40 Hz	0	0.02	–
40 – 100 Hz	0	0.01	0.55
100 – 200 Hz	0	0	0.2
200 Hz – 1 kHz	0	0	0.02
>1 kHz	0	0	0

Resistance

Specifications are for 4-wire resistance function, 2 x 4-wire resistance, or 2-wire resistance with zero. If zero is not used, add 0.2 Ω for 2-wire resistance plus lead resistance, and add 20 mΩ for 2 x 4-wire resistance function.

Measurement Method ..... Current source referenced to LO input

Max. Lead Resistance (4-wire ohms) ..... 10 % of range per lead for 10 Ω, 100 Ω, 1 kΩ ranges. 1 kΩ per lead on all other ranges

Input Protection ..... 1000 V on all ranges

Common Mode Rejection ..... 140 dB at 50 or 60 Hz ±0.1 % (1 kΩ unbalance)

Normal Mode Rejection ..... 60 dB for NPLC of 1 or greater with analog filter off and power line frequency ±0.1 %
100 dB for NPLC of 1 or greater with analog filter on and power line frequency ±0.1 %

Analog Filter ..... When using the analog filter, specifications are relative to within one hour of using the ZERO function for that range and NPLC setting.

Input Characteristics

Range	Resolution	Resolution			Source Current
		4½ Digits	5½ Digits	6½ Digits	
10 Ω	10.00000 Ω	1 mΩ	100 µΩ	10 µΩ	5 mA/13 V
100 Ω	100.0000 Ω	10 mΩ	1 mΩ	100 µΩ	1 mA/6 V
1 kΩ	1.000000 kΩ	100 mΩ	10 mΩ	1 mΩ	1 mA/6 V
10 kΩ	10.00000 kΩ	1 Ω	100 mΩ	10 mΩ	100 µA/6 V
100 kΩ	100.0000 kΩ	10 Ω	1 Ω	100 mΩ	100 µA/13 V
1 MΩ	1.000000 MΩ	100 Ω	10 Ω	1 Ω	10 µA/13 V
10 MΩ	10.00000 MΩ	1 kΩ	100 Ω	10 Ω	1 µA/13 V
100 MΩ	100.0000 MΩ	10 kΩ	1 kΩ	100 Ω	1 µA || 10 MΩ/10 V
1.0 GΩ	1.000000 GΩ	100 kΩ	10 kΩ	1 kΩ	1 µA || 10 MΩ/10 V

4040/4050 Accuracy

Accuracy is given as ± (% measurement + % of range)

Range	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
10 Ω	0.003 + 0.01	0.008 + 0.03	0.01+ 0.03	0.0006 + 0.0005
100 Ω	0.003 + 0.003	0.008 + 0.004	0.01 + 0.004	0.0006 + 0.0005
1 kΩ	0.002 + 0.0005	0.008 + 0.001	0.01 + 0.001	0.0006 + 0.0001
10 kΩ	0.002 + 0.0005	0.008 + 0.001	0.01 + 0.001	0.0006 + 0.0001
100 kΩ	0.002 + 0.0005	0.008 + 0.001	0.01 + 0.001	0.0006 + 0.0001
1 MΩ	0.002 + 0.001	0.008 + 0.001	0.01 + 0.001	0.001 + 0.0002
10 MΩ	0.015 + 0.001	0.02 + 0.001	0.04 + 0.001	0.003 + 0.0004
100 MΩ	0.3 + 0.01	0.8 + 0.01	0.8 + 0.01	0.15 + 0.0002
1 GΩ	1.0 + 0.01	1.5 + 0.01	2.0 + 0.01	0.6 + 0.0002

Additional Ohms Errors

Digits	NPLC	Additional NPLC Noise Error
6½	100	0 % of range
6½	10	0 % of range
5½	1	0.001 % of range
5½	0.2	0.003 % of range ±7 mΩ
4½	0.02	0.017 % of range ±15 mΩ

DC Current

Input Protection ..... Tool-accessible 11 A/1000 V and 440 mA/1000 V fuses, limits of 400 mA continuous 550 mA for 2 minutes on, 1 minute off.

Common Mode Rejection ..... 140 dB at 50 or 60 Hz ±0.1 % (1 kΩ unbalance)

Normal Mode Rejection ..... 60 dB for NPLC of 1 or greater with analog filter off and power line frequency ±0.1 %
100 dB for NPLC of 1 or greater with analog filter on and power line frequency ±0.1 %

Analog Filter ..... When using the analog filter, specifications are relative to within one hour of using the ZERO function for that range and NPLC setting.

Input Characteristics

Range	Resolution	Resolution			Shunt Resistance (Ohms)	Burden Voltage
		4½ Digits	5½ Digits	6½ Digits		
100 µA	100.0000 µA	10 nA	1 nA	100 pA	100 Ω	<0.015 V
1 mA	1.000000 mA	100 nA	10 nA	1 nA	100 Ω	<0.15 V
10 mA	10.00000 mA	1 µA	100 nA	10 nA	1 Ω	<0.025 V
100 mA	100.0000 mA	10 µA	1 µA	100 nA	1 Ω	<0.25 V
400 mA [3]	400.000 mA	100 µA	10 µA	1 µA	1 Ω	<0.50 V
1 A [2]	1.000000 A	100 µA	10 µA	1 µA	0.01 Ω	<0.05 V
3 A [1]	3.00000A	1 mA	100 µA	10 µA	0.01 Ω	<0.15 V
10 A	10.00000 A	1 mA	100 µA	10 µA	0.01 Ω	<0.5 V

[1] Part of 10 A range.

[2] Available on the front panel terminal only.

[3] 400 mA available in software version 2.0 or greater only. 400 mA continuously; 550 mA for 2 minutes on, 1 minute off.

4040/4050 Accuracy

Accuracy is given as ± (% measurement + % of range)

Range	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
100 µA[4]	0.01 + 0.02	0.04 + 0.025	0.05 + 0.025	0.002 + 0.003
1 mA	0.007 + 0.005	0.030 + 0.005	0.05 + 0.005	0.002 + 0.0005
10 mA[4]	0.007 + 0.02	0.03 + 0.02	0.05 + 0.02	0.002 + 0.002
100 mA	0.01 + 0.004	0.03 + 0.005	0.05 + 0.005	0.002 + 0.0005
400 mA [3]	0.03 + 0.004	0.04 + 0.005	0.05 + 0.005	0.005 + 0.0005
1 A [2]	0.03 + 0.02	0.04 + 0.02	0.05 + 0.02	0.005 + 0.001
3 A [1][2]	0.05 + 0.02	0.08 + 0.02	0.1 + 0.02	0.005 + 0.002
10 A [2]	0.1 + 0.008	0.12 + 0.008	0.15 + 0.008	0.005 + 0.0008

[1] Part of 10 A range

[2] Available at front panel connectors only

[3] 400 mA available in software version 2.0 or greater only. 400 mA continuously; 550 mA for 2 minutes on, 1 minute off.

[4] In RF fields of 3 V/m amd frequencies of 1.7 GHz to 1.9 GHz, add 0.06% of range. With conducted RF voltages of 3 Vrms and frequencies of 20 MHz to 50 MHz, add 0.08% of range.

Additional Current Errors

Digits	NPLC	Additional NPLC Noise Error for 1 mA, 100 mA, 400 mA, 3 A and 10 A	Additional NPLC Noise Error for 100 µA, 10 mA, 1 A
6½	100	0 % of range	0 % of range
6½	10	0 % of range	0 % of range
5½	1	0.001 % of range	0.01 % of range
5½	0.2	0.011 % of range ±4 µA	0.11 % of range ±4 µA
4½	0.02	0.04 % of range ±4 µA	0.28 % of range ±4 µA

AC Current

The following ac current specifications are for sinusoidal signals with amplitudes greater than 5 % of range. For inputs from 1 % to 5 % of range, add an additional error of 0.1 % of range.

Input Protection ..... Tool accessible 11 A/1000 V and 440 mA/1000 V fuses, limits of 400 mA continuous 550 mA for 2 minutes on, 1 minute off.

Measurement Method ..... ac-coupled true-rms, dc-coupled to the fuse and shunt (no blocking capacitor)

AC Filter Bandwidth

Slow ..... 3 Hz to 10 kHz

Medium ..... 20 Hz to 10 kHz

Fast ..... 200 Hz to 10 kHz

Crest Factor Error (applies to non-sinusoidal waveforms only)

Maximum Crest Factor ..... 5:1 at full scale

Additional Crest Factor Errors (<100 Hz) ..... Crest factor 1-2, 0.05 % of full scale
Crest factor 2-3, 0.2 % of full scale
Crest factor 3-4, 0.4 % of full scale
Crest factor 4-5, 0.5 % of full scale

Input Characteristics

Range	Resolution	Resolution			Shunt Resistance (Ohms)	Burden Voltage
		4½ Digits	5½ Digits	6½ Digits		
100 µA	100.0000 µA	10 nA	1 nA	100 pA	100 Ω	<0.015 V
1 mA	1.000000 mA	100 nA	10 nA	1 nA	100 Ω	<0.15 V
10 mA	10.00000 mA	1 µA	100 nA	10 nA	1 Ω	<0.025 V
100 mA	100.0000 mA	10 µA	1 µA	100 nA	1 Ω	<0.25 V
400 mA [3]	400.000 mA	100 µA	10 µA	1 µA	1 Ω	<0.50 V
1 A [2]	1.000000 A	100 µA	10 µA	1 µA	0.01 Ω	<0.05 V
3 A [1][2]	3.00000 A	1 mA	100 µA	10 µA	0.01 Ω	<0.05 V
10 A [2]	10.00000 A	1 mA	100 µA	10 µA	0.01 Ω	<0.5 V

[1] Part of 10 A range

[2] Available at front panel connectors only

[3] 400 mA available in software version 1.0.700.18 or greater only. 400 mA continuously; 550 mA for 2 minutes on, 1 minute off; maximum crest factor 3:1 at 400 mA

4040/4050 Accuracy

Accuracy is given as ± (% measurement + % of range)

Range	Frequency (Hz)	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
100 µA	3 – 5 Hz	1.1 + 0.06	1.1 + 0.06	1.1 + 0.06	0.2 + 0.006
	5 – 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.1 + 0.006
	10 Hz – 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15 + 0.06	0.015 + 0.006
	5 – 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006
1 mA	3 – 5 Hz	1.0 + 0.04	1.0 + 0.04	1.0 + 0.04	0.1 + 0.006
	5 – 10 Hz	0.3 + 0.04	0.3 + 0.04	0.3 + 0.04	0.035 + 0.006
	10 Hz – 5 kHz	0.1 + 0.04	0.1 + 0.04	0.1 + 0.04	0.015 + 0.006
	5 – 10 kHz	0.2 + 0.25	0.2 + 0.25	0.2 + 0.25	0.03 + 0.006
10 mA	3 – 5 Hz	1.1 + 0.06	1.1 + 0.06	1.1 + 0.06	0.2 + 0.006
	5 – 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.1 + 0.006
	10 Hz – 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15+ 0.06	0.015 + 0.006
	5 – 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006
100 mA	3 – 5 Hz	1.0 + 0.04	1.0 + 0.04	1.0 + 0.04	0.1 + 0.006
	5 – 10 Hz	0.3 + 0.04	0.3 + 0.04	0.3 + 0.04	0.035 + 0.006
	10 Hz – 5 kHz	0.1 + 0.04	0.1 + 0.04	0.1 + 0.04	0.015 + 0.006
	5 – 10 kHz	0.2 + 0.25	0.2 + 0.25	0.2 + 0.25	0.03 + 0.006
400 mA [3]	3 – 5 Hz	1.0 + 0.1	1.0 + 0.1	1.0 + 0.1	0.1 + 0.006
	5 – 10 Hz	0.3 + 0.1	0.3 + 0.1	0.3 + 0.1	0.035 + 0.006
	10 Hz – 1 kHz	0.1 + 0.1	0.1 + 0.1	0.1 + 0.1	0.015 + 0.006
	1kHz – 10 kHz	0.2 + 0.7	0.2 + 0.7	0.2 + 0.7	0.03 + 0.006
1 A [2]	3 – 5 Hz	1.0 + 0.04	1.0 + 0.04	1.0 + 0.04	0.1 + 0.006
	5 – 10 Hz	0.3 + 0.04	0.3 + 0.04	0.3 + 0.04	0.035 + 0.006
	10 Hz – 5 kHz	0.1 + 0.04	0.1 + 0.04	0.1 + 0.04	0.015 + 0.006
	5 – 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006
3 A [1][2]	3 – 5 Hz	1.1 + 0.06	1.1 + 0.06	1.1 + 0.06	0.1 + 0.006
	5 – 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.035 + 0.006
	10 Hz – 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15 + 0.06	0.015 + 0.006
	5 – 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006
10 A [2]	3 – 5 Hz	1.1 + 0.06	1.1 + 0.06	1.1 + 0.06	0.1 + 0.006
	5 – 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.035 + 0.006
	10 Hz – 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15 + 0.06	0.015 + 0.006
	5 – 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006

[1] Part of 10 A range

[2] Available only on front panel connectors

[3] 400 mA available in software version 1.0.700.18 or greater only. 400 mA continuously; 550 mA for 2 minutes on, 1 minute off; maximum crest factor 3:1 at 400 mA; specification for current above 329 mA is typical.

Additional Low Frequency Errors

Error is stated as % of reading.

Frequency	AC Filter		
	3HZ (slow)	20HZ (medium)	200HZ (fast)
10 – 20 Hz	0	0.25	–
20 – 40 Hz	0	0.02	–
40 – 100 Hz	0	0.01	0.55
100 – 200 Hz	0	0	0.2
200 Hz – 1 kHz	0	0	0.02
> 1 kHz	0	0	0

Frequency

Gate Times ..... Programmable to 1 s, 100 ms, and 10 ms

Measurement Method ..... Flexible counting technique. AC-coupled input using the ac voltage measurement function.

Settling Considerations ..... When measuring frequency or period after a dc offset voltage change, errors may occur. For the most accurate measurement, wait up to 1 second for the input blocking capacitor to settle.

Measurement Considerations ..... To minimize measurement errors, shield inputs from external noise when measuring low-voltage, low-frequency signals.

4040/4050 Accuracy

Accuracy is given as ± % measurement

Range	Frequency	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
100 mV to 1000 V[1][2]	3 – 5 Hz	0.1	0.1	0.1	0.005
	5 – 10 Hz	0.05	0.05	0.05	0.005
	10 – 40 Hz	0.03	0.03	0.03	0.001
	40 Hz – 300 kHz	0.006	0.01	0.01	0.001
	300 kHz – 1 MHz	0.006	0.01	0.01	0.001

[1] Input >100 mV. For 10 – 100 mV, multiply percent measurement error by 10.

[2] Limited to 8 X 10^7 volt-Hertz

Gate Time vs. Resolution

Gate Time	Resolution
0.01	5½
0.1	6½
1.0	6½

Additional Low Frequency Errors

Error stated as percent of measurement for inputs >100 mV. For 10 – 100 mV, multiply percent by 10.

Frequency	Resolution		
	6½	5½	4½
3 – 5 Hz	0	0.12	0.12
5 – 10 Hz	0	0.17	0.17
10 – 40 Hz	0	0.2	0.2
40 – 100 Hz	0	0.06	0.21
100 – 300 Hz	0	0.03	0.21
300 Hz – 1 kHz	0	0.01	0.07
> 1 kHz	0	0	0.02

Capacitance (4050 Only)

Accuracy is stated as ±(% of measurement + % of range)

Range	Resolution	1 Year Accuracy [1] (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
1 nF	1 pF	2% ± 2.5 %	0.05 + 0.05
10 nF	10 pF	1% ± 0.5 %	0.05 + 0.01
100 nF	100 pF	1% ± 0.5 %	0.01 + 0.01
1 µF	1 nF	1% ± 0.5 %	0.01 + 0.01
10 µF	10 nF	1% ± 0.5 %	0.01 + 0.01
100 µF	100 nF	1% ± 0.5 %	0.01 + 0.01
1 mF	1 µF	1% ± 0.5 %	0.01 + 0.01
10 mF	10 µF	1% ± 0.5 %	0.01 + 0.01
100 mF	100 µF	4% ± 0.2 %	0.05 + 0.05
[1] Stated accuracy is attained when Zero function is used.			

Temperature (4050 only)

Test Current ..... 1 mA

Accuracy is stated as ± °C and is based on a Platinum RT100 (DIN IEC 751, 385 type) RTD with less than 10 ohms lead resistance. The accuracy listed in the table below are valid only when using the 4-wire RTD measurement function. Specifications do not include probe accuracy, which must be added.

Range	Resolution	Accuracy		Temperature Coefficient/ °C Outside 18 to 28 °C
		90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	
-200 °C	0.001 °C	0.06	0.09	0.0025
-100 °C	0.001 °C	0.05	0.08	0.002
0 °C	0.001 °C	0.04	0.06	0.002
100 °C	0.001 °C	0.05	0.08	0.002
300 °C	0.001 °C	0.1	0.12	0.002
600 °C	0.001 °C	0.18	0.22	0.002

Additional Errors

Digits	NPLC	Additional NPLC Noise Error
6 ½	100	0 °C
6 ½	10	0 °C
5 ½	1	0.03 °C
5 ½	0.2	0.12 °C
4 ½	0.02	0.6 °C

Continuity

Continuity Threshold ..... Selectable between 1 Ω and 1000 Ω

Test Current ..... 1 mA

Response Time ..... 300 samples/sec with audible tone

Accuracy is given as ± (% measurements + % of range)

Range	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
1000.0 Ω	0.002 + 0.01	0.008 + 0.02	0.01 + 0.02	0.001 + 0.002

Diode Test

Test Current ..... 100 µA or 1 mA

Response Time ..... 300 samples/sec with audible tone.

Accuracy is given as ± (% measurements + % of range)

Range	24 Hour (23 ±1 °C)	90 Days (23 ±5 °C)	1 Year (23 ±5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
5.0000 V	0.002 + 0.002	0.008 + 0.002	0.01 + 0.002	0.001 + 0.002
10.0000 V	0.002 + 0.001	0.008 + 0.002	0.01 + 0.002	0.001 + 0.002

Measurement Rates (IEEE488[4])

Function	Digits	Setting	Integration Time 60 Hz (50 Hz)	Measurements/Second [1]	
				4040	4050
DC Volts, DC Current, and Resistance	6½	100 NPLC	1.67 (2) s	0.6 (0.5)	0.6 (0.5)
	6½	10 NPLC	167 (200) ms	6 (5)	6 (5)
	5½	1 NPLC	16.7 (20) ms	60 (50)	60 (50)
	5½	0.2 NPLC	3.3 ms	270	270
	4½	0.02 NPLC	500 us	995	995
AC Voltage and AC Current [2]	6½	3 Hz		0.47	0.47
	6½	20 Hz		1.64	1.64
	6½	200 Hz [3]		4.5	4.5
Frequency and Period	6½	1 s		1	1
	5½	100 ms		9.8	9.8
	4½	10 ms		80	80
Capacitance	6½			NA	2

[1] Typical measurement rates with auto-zero off, delay = 0, display off, auto range off and math off.

[2] Maximum measurement rates for 0.01 % of ac step. When dc input varies, additional settling delay is required.

[3] For remote operation or external trigger using default settling delay

[4] Speeds available in OutG SW 1.0.700.18 or higher. Note that the measurements rates for RS232 can vary depending on the baud rate chosen. If the baud rate selected is 115,200, the maximum measurement rate is 711 measurement/s. The LAN bus has a maximum measurement rate of 963 measurement/s.